Stormwater Quality Management Plan

The Pinnacle at Arise, Rochedale

Rochedale C4 Pty Ltd

Colliers

20-0102SQMP01-V3
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EXECUTIVE SUMMARY

Colliers International Engineering & Design Pty Ltd have been engaged by Rochedale C4 Pty Ltd to provide a Stormwater Quality Management Plan in support of a development application to Brisbane City Council (BCC) for 'The Pinnacle' development. The proposed development is located at 520-560 Rochdale Road, Rochedale currently described as Lot 1 on SP288673, Lot 3 on RP181371, and Lots 700 & 701 on SP309377. This development application seeks a development permit for a Reconfiguring of Lot application to create residential lots, roads and greenspace.

The purpose of this document is to demonstrate the proposed stormwater quality management strategy for the operational phase of the development achieves the requirements and targets of Brisbane City Council's Planning Scheme (2014), as well as the relevant provisions of the State Planning Policy (2017).

The total site area across all land holdings by Rochedale C4 Pty Ltd for this application is approximately 23.02ha. It is predominantly zoned as an emerging community zone, however, is currently undeveloped and consistent with a rural residential land use. There is an area of high-density wooded vegetation on Lot 2 on RP181371, zoned as an environmental management zone. The total proposed development footprint for the site is approximately 12.73ha, not including stormwater quality improvement devices.

Environmental best management practices are proposed for treatment of stormwater flowing from the site. Stormwater runoff from the site will pass through bioretention basins and tree pits to be constructed within the designated lots prior to discharge to the receiving environment. The water quality modelling results found annual load reductions of Total Suspended Solids, Total Phosphorus, Total Nitrogen and Gross Pollutants between the Mitigated and Unmitigated Scenarios are achieved through three (3) bioretention basins and six (6) tree pits. The proposed filter media areas for the bioretention basins are set out Table 2-6. The proposed filter media area for each tree pit is 2.25m^2.

This Stormwater Quality Management Plan demonstrates compliance with the pollutant load reduction targets of the Brisbane City Council Planning Scheme (2014) during the operational phase of the proposed development.

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1. INTRODUCTION

Colliers International Engineering & Design Pty Ltd have been engaged by Rochedale C4 Pty Ltd to provide a Stormwater Quality Management Plan (SMQP) in support of a development application to Brisbane City Council (BCC) for 'The Pinnacle' development. The proposed development is located at 520-560 Rochdale Road, Rochedale currently described as Lot 1 on SP288673, Lot 2 & 3 on RP181371 and Lots 700 & 701 on SP309377. This development application seeks a development permit for a Reconfiguring of Lot (RoL) application to create residential lots, roads and greenspace.

The purpose of this document is to demonstrate the proposed stormwater quality management strategy for the operational phase of the development achieves the requirements and targets of Brisbane City Council's Planning Scheme (2014), as well as the relevant provisions of the State Planning Policy (2017). The intent of the codes associated with these documents will be achieved through the appropriate integration of stormwater management options within the proposed residential land-use.

The objectives of this SMQP are to:

- Detail the proposed stormwater quality management strategy and how the load reduction objectives specified by the State Planning Policy (SPP, DSDIP 2017) and Schedule 6.16.7.9.3 of the BCC Planning Scheme are achieved during the operational phase of the development;
- Consider suitable Stormwater Quality Improvement Devices (SQID's) based on Water Sensitive Urban Design (WSUD) principles; and
- Outline the maintenance requirements for the proposed stormwater quality improvement devices.

The intent of the RoL has been demonstrated by a Plan of Reconfiguration showing the layout of the proposed development (refer to Appendix B). The Plan of Reconfiguration is indicative only and has been prepared for the purposes of demonstrating a functional and feasible development outcome consistent with the BCC Planning Scheme. The development application for the proposed site includes Stages 2-4 as per approval A005364788.

1.1. Assessment Status and Background

A Site Based Stormwater Management Plan exists over Stage 2-4 of The Pinnacle, which has been developed as part of a previous development application (Application Reference: A005364788). The plan is pertinent to the bioretention basin located in the northwest corner of 520 Rochedale Road (2RP181371) which discharges towards Rochedale Road and the proposed trunk stormwater network in Rochedale Road. The previous application was approved by BCC with conditions to include the detention basin sized in accordance with the approved concept requirements and the BCC issued Concept Trunk Stormwater Strategy (dated 02/04/2020). For further information on the technical details regarding the bioretention basin, refer to the Site Based Stormwater Management Plan developed by Arcadis, titled "The Pinnacle, Rochedale" dated 08 September 2017 (document reference: F0001-AA007701-AAR).

1.2. Site Location

The location of the proposed development site is shown in Figure 1-1, and has an approximate total lot area of 23.02ha. The site is predominantly zoned as an emerging community zone, is currently undeveloped and consistent with a rural residential land use. There is an area of high-density wooded vegetation on Lot 2 on RP181371, zoned as an environmental management zone. The total proposed development footprint for the site is approximately 12.73ha.

The site is accessed by Rochedale Road along the western boundary. The surrounding lots are consistent with rural residential land use and have been zoned as emerging community. Both upstream and downstream of the site have been zoned as emerging community. The downstream Lots 1 and 2 on RP71823 are currently under lawful control of the applicant and have been designated for future development under a separate RoL.

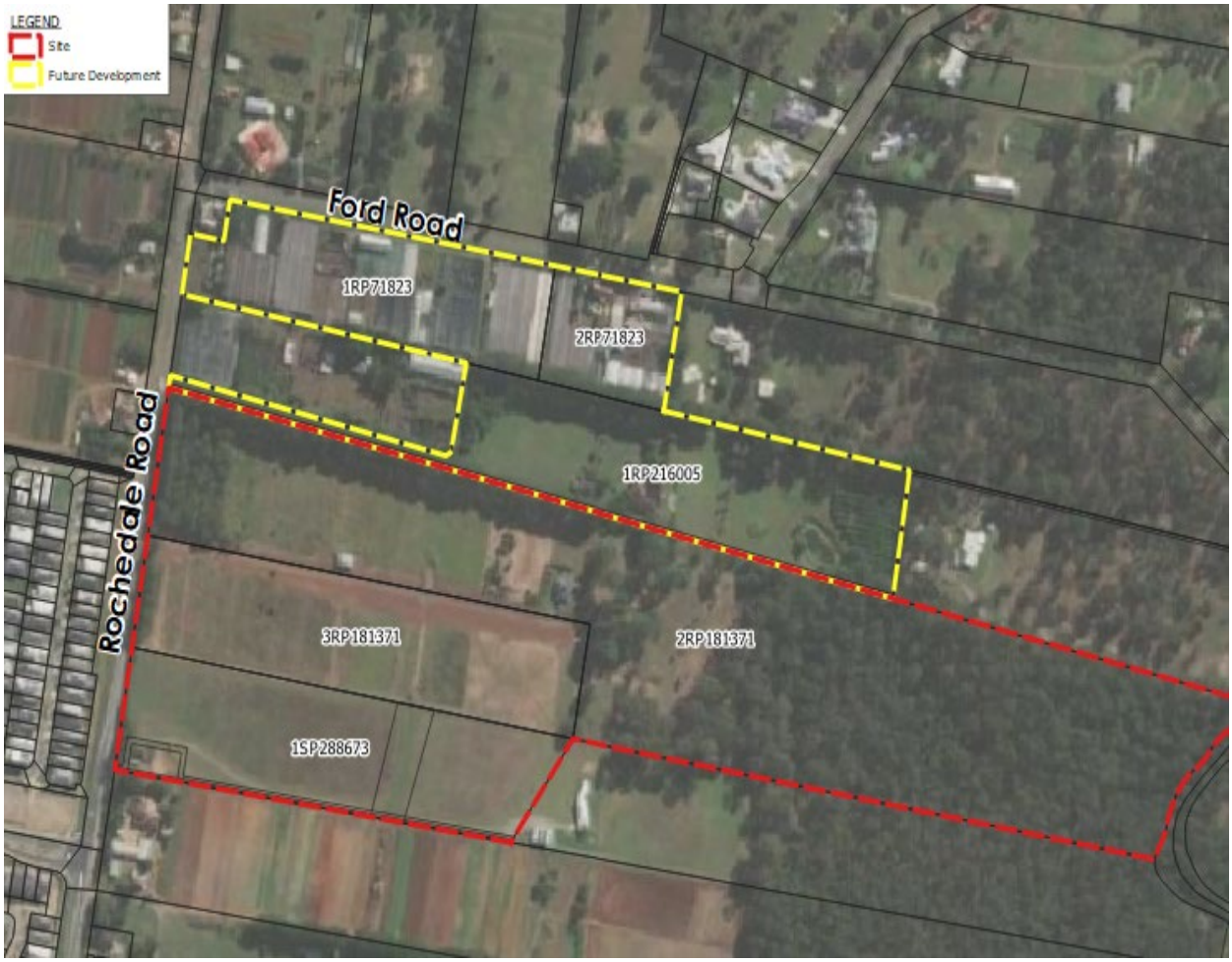


Figure 1-1: Site Location (*Source: ESRI Imagery 2020*)

2. STORMWATER QUALITY

2.1. Design Objectives

This report identifies the stormwater quality management objectives for the operational phase (post-construction phase) of the proposed development. Construction based stormwater quality management objectives will need to be addressed as part of operational works documentation.

The stormwater quality design objectives adopted for this report are in accordance with Schedule 6.16.7.9.3 of the BCC Planning Scheme (2014). This is the equivalent of the load-based Water Quality Objectives (WQO's) stipulated in the State Planning Policy (DILGP, 2017) for the Southeast Queensland region. See Table 2-1 for the minimum mean annual load reductions to be achieved by the new developments.

Table 2-1: Site Stormwater Quality Objectives (Operational Phase)

Minimum reductions in mean annual loads from unmitigated development (%)			
Total Suspended Solids (TSS)	**Total Phosphorous (TP)**	**Total Nitrogen (TN)**	**Gross pollutants >5 mm**
80	60	45	90

2.2. Stormwater Quality Treatment

2.2.1. Strategy

The objective of this report is to assess the stormwater quality measures required based on the development layout to support the development application. Runoff from the development will be collected in the minor stormwater drainage system and discharged into multiple bioretention basins and tree pits across the development for treatment. Locations of bioretention basins have been determined based on practical minor drainage discharge locations considering topographical constraints. Where it is not practical to direct runoff to a bioretention basin, tree pits have been proposed as the treatment method. The proposed bioretention basin and tree pit locations are shown in Figure 2-1. This shows runoff from the proposed development will be treated through three (3) bioretention basins and a total of six (6) tree pits. It is noted that the use of tree pits may offset some of the minimum required bioretention basin area for catchments. This option has not been documented under this application, however, may be explored at operational works documentation.

As discussed in Section 1.1, an existing approval exists for the bioretention basin in the northwest corner of 520 Rochedale Road (referred to as 'Basin C' herein). The approved application has sized the basin with 870m^2 of filter media area based on a superseded Plan of Reconfiguration. This SQMP incorporates the previously approved basin within the water quality modelling to reflect updates to the sub-catchment based on the current Plan of Reconfiguration, as included in Appendix B.

This plan sizes the required bioretention basins to treat runoff from the proposed development of this site only, making no allowance for treatment of future development upstream.

2.2.2. Catchment Areas

The development site has been split into five (5) sub-catchments containing split source nodes (road, roof and ground). The sub-catchments represent the total developed area reporting to the water quality treatment devices or bypassing treatment. Table 2-2 details the catchment areas and imperviousness represented within the MUSIC model. The stormwater quality catchments are shown in Figure 2-1.

Table 2-2: Water Quality Catchment Areas

Catchment	Total Area (ha)	Road (ha) / 60% imp	Roof (ha) / 100% imp	Ground (ha) / 20% imp
Catchment C	5.316	1.508	2.000	1.809
Catchment D	0.435	0.112	0.129	0.194
Catchment E	3.678	0.829	1.097	1.753
Catchment F	2.179	0.548	0.839	0.793
Untreated Catchments	0.081	0.081	0.000	0.000
Total	**11.689**	**4.064**	**4.064**	**4.548**

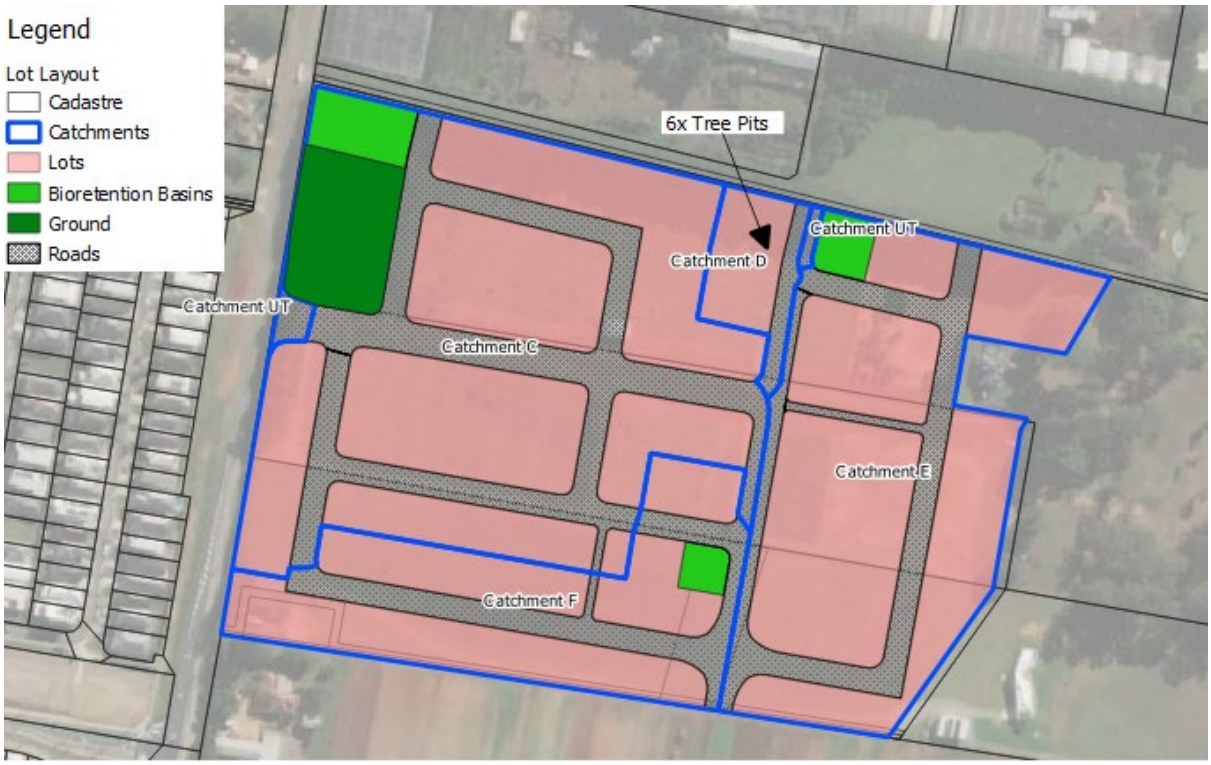


Figure 2-1: WSUD Catchment Locality Plan

2.2.3. MUSIC Parameters

An assessment of stormwater runoff quality from the existing conditions and proposed developed conditions has been undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) – Version 6.3, released in 2018.

Climate data for the catchment was sourced from the MUSIC model database. The rainfall and evaporation data template for this site has been based on data from Brisbane Airport (40223) from 1/01/1980-31/12/1989 with six (6) minute rainfall duration.

Table 2-3 and Table 2-4 outline the adopted source node parameters from "MUSIC Modelling Guidelines" (Water by Design, 2010) that were used in the MUSIC model.

Table 2-3: Urban land use (Split Source Nodes) - Pollutant Export Parameters

Land Use	Parameter	Total Suspended Solids (Log_{10} mg/L)		Total Phosphorous (Log_{10} mg/L)		Total Nitrogen (Log_{10} mg/L)	
		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Ground	Mean	2.18	1.0	-0.47	-0.97	0.26	0.20
	Std Deviation	0.39	0.34	0.31	0.31	0.23	0.20
Road	Mean	2.43	1.0	-0.30	-0.97	0.26	0.20
	Std Deviation	0.39	0.34	0.31	0.31	0.23	0.20
Roof	Mean	1.30	N/A	-0.89	N/A	0.26	N/A
	Std Deviation	0.39	N/A	0.31	N/A	0.23	N/A

Table 2-4: MUSIC Runoff Generation Parameters

Parameter	Urban
Rainfall Threshold (mm)	1
Soil Capacity (mm)	500
Initial Storage (%)	10
Field Capacity	200
Infiltration Capacity Coefficient a	211
Infiltration Capacity Coefficient b	5
Initial Depth (mm)	50
Daily Recharge (%)	28
Daily Drainage (%)	27
Daily Deep Seepage Rate (%)	0

2.2.4. MUSIC Model Layout

As the management of urban stormwater needs to take a holistic approach, specific management measures need to be implemented in series to form a treatment train. The correct utilisation of various devices within the treatment train is imperative to target the desired pollutants, from the gross solids to the fine colloidal partials. Figure 2-2 shows the MUSIC model layout for the proposed development.

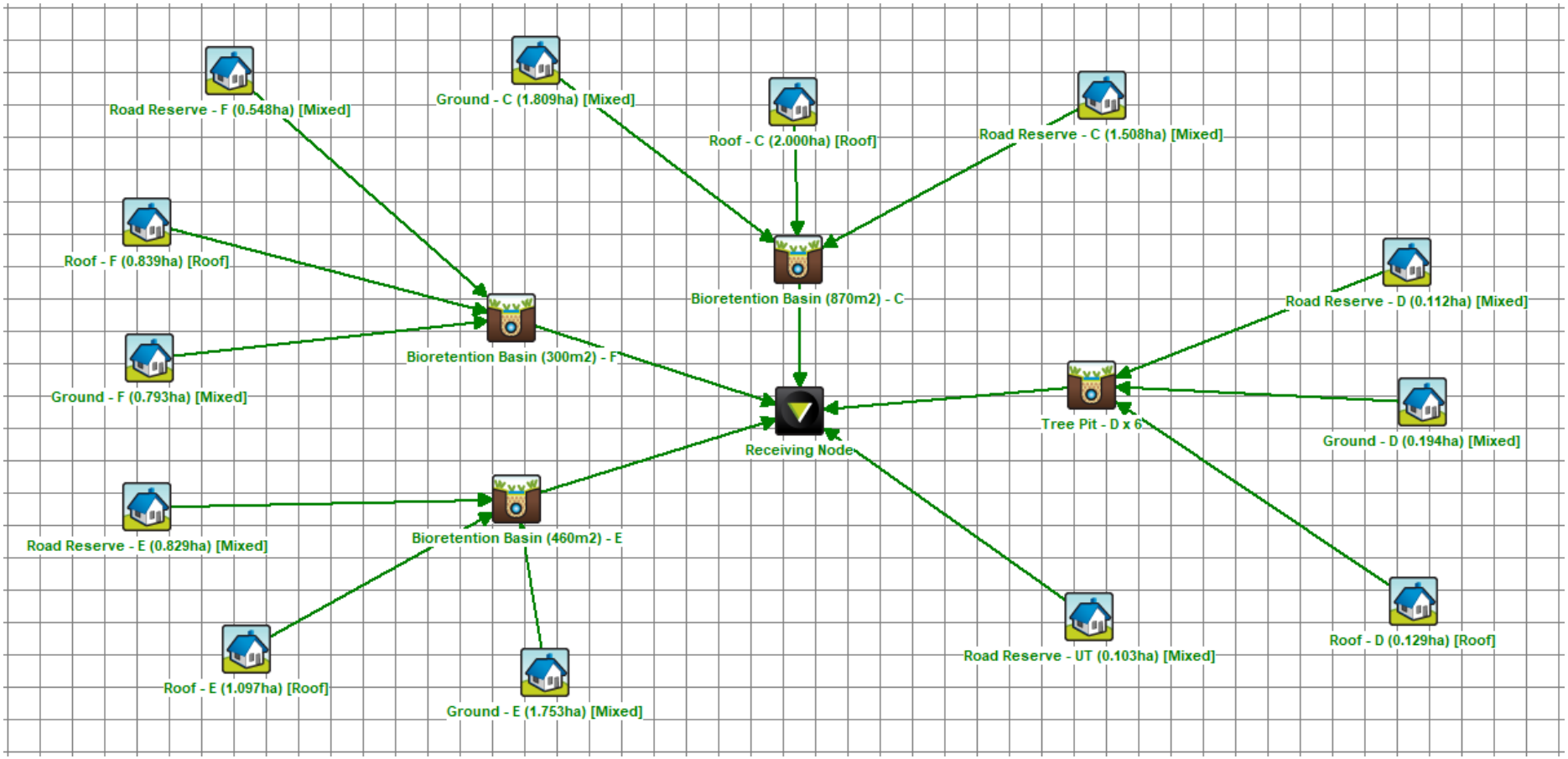


Figure 2-2: MUSIC Model Layout

2.3. Treatment Measures

2.3.1. Bioretention Systems and Tree Pits

Bioretention and tree pit systems use ponding above a treatment surface to maximise the volume of runoff flowing through the filtration media. They typically convey flows above the design event through overflow pits or a weir. The treatment system operates by firstly filtering surface flows through surface vegetation and then percolating runoff through prescribed filtration media. This media provides treatment through fine filtration, extended detention and biological uptake of nutrients.

As these systems take approximately 12-24hrs to drain, the maximum depth of pondage allowed to occur over the filter area has been limited to 300mm, with a minimum filter media depth of 500mm for bioretention basins and 750mm for tree pits. Table 2-6 summarises the proposed design parameters for the main bioretention systems and tree pits for this development. All tree pits are to be designed and installed in accordance with BCC standard drawings BSD-9031 and have a total area of 2.25m^2 per tree pit. As noted above this may be split into several devices on detailed design.

It is to be noted that the Orthophosphate content of the filter media has been reduced to 30mg/kg in line with recent advice from Water by Design (2018).

2.3.2. Sediment Forebays

To ensure that the deposition of coarse sediment on the filter media surface does not affect the bioretention system function, bioretention systems should be designed with pre-treatment to limit the amount of coarse sediment reaching the filter media. A sediment forebay will be required to pre-treat runoff for each proposed bioretention basin where their contributing catchment is greater than 2 ha. This includes all proposed bioretention basins on the site.

2.4. Results

MUSIC modelling of the proposed treatment train for the developable area of 'the Pinnacle' subdivision was performed to ensure the WQO's were achieved. Table 2-5 presents the load-based outputs that are represented by this application. The results show the mitigated scenario achieves compliant load reductions satisfying the requirements set out by Schedule 6.16.7.9.3 of the BCC Planning Scheme (2014).

Table 2-5: MUSIC Results – Load Based Pollutant Outputs

Pollutant	Unmitigated (kg/y)	Mitigated (kg/y)	Reduction Achieved	Target Reduction	Compliance
TSS	13600	2620	80.8%	80%	✓
TP	28.6	7.15	75.0%	60%	✓
TN	174	77.3	55.7%	45%	✓
GP	2040	89.2	95.6%	90%	✓

Table 2-6: Bioretention Design Parameters

Catchment	C	D	E	F
Treatment	**Bioretention Basin**	**6x Tree Pits**	**Bioretention Basin**	**Bioretention Basin**
High Flow By-pass (m^3/s)	0.39	0.01	0.26	0.18
Extended Detention Depth (m)	0.30	0.17	0.3	0.3
Storage Surface Area (m^2)	870	13.5	460	300
Filter Media Area (m^2)	870	13.5	460	300
Unlined Filter Media Perimeter (m)	0.01	0.01	0.01	0.01
Saturated Hydraulic Conductivity (mm/hr)	200	200	200	200
Filter Depth (m)	0.5	0.8	0.5	0.5
TN Content of Filter Media (mg/kg)	400	400	400	400
Orthophosphate Content of Filter Media (mg/kg)	30	30	30	30
Exfiltration Rate (mm/hr)	0.0	0.0	0.0	0.0
Sediment Basin	Y	N	Y	Y

3. CONSTRUCTION PHASE MANAGEMENT

3.1. Erosion and Sediment Control

The management of the site during the construction phase is an important step in ensuring water quality standards are achieved. Implementation of best practice Erosion and Sediment Control techniques is imperative to managing the quality of runoff affected by construction works.

The following points provide general guidance on the management of stormwater during the construction phase. Detailed Erosion and Sediment Control Management Plans should be developed in conjunction with the Operational Works design prior to construction works commencing in accordance with the International Erosion Control Association (IECA) - "*Best Practice Erosion and Sediment Control (BPESC) document*" and overseen by a Certified Professional in Erosion and Sediment Control (CPESC) or Registered Professional Engineer Queensland (RPEQ).

1. Establish a single stabilised entry/exit point for the site works.
2. Construct a shake-down grid at the entrance to facilitate the removal of sediment from trucks leaving the site. The access road extending from the end of existing road or kerb to the grid should comprise a 150-200mm deep pad of 40mm crushed rock.
3. Install sediment fences along the lower boundaries of the site.
4. Construct one or more strategically placed sediment basins in the proposed drainage reserve and construct contour drains / bunds to direct disturbed runoff to the sediment basins.
5. Install bins and/or wind-proof litter areas on-site to minimise the dispersion of gross pollutants.
6. Maintain on site sufficient materials necessary for the emergency repair of all erosion control devices. This includes silt fences, clean crushed rock for reapplication to the entrance road and for replacement of rock within temporary drainage channels, and flocculants for settling sediment basins.
7. Following each day's construction works, ensure that any material on road surfaces is swept from the road, and not permitted to be washed down the gutters and piped drainage systems.
8. Quality of pooled water within sediment basins are to be monitored prior to dewatering, sufficient time should be given to allow sediment to settle (possible with the assistance of a suitable flocculent if necessary) &/or filtering during pumping operations.
9. Final establishment of bioretention basin should not occur until full stabilisation of upstream catchment has occurred; preferably these should be temporarily turfed during the maintenance period while dwelling construction is occurring.

It shall be the responsibility of the developer, through their principal contractor, to ensure that temporary sediment and erosion controls are installed and maintained correctly.

4. ESTABLISHMENT AND OPERATIONAL PHASE MANAGEMENT

4.1. Establishment

Experience shows that the critical periods in the life of WSUD vegetated stormwater systems are the construction and establishment phases. The timing and approach to these systems must be carefully considered to ensure successful establishment and long-term performance. Bioretention systems are now common stormwater treatment devices for new urban developments in Queensland. Successful construction and allowing adequate time for the systems to establish is critical to their long-term performance and function. Construction of the system is also linked to having suitable bioretention designs in place to ensure, civil contractors have appropriate plans to construct to. Applying due care in the design and construction phase will ensure the function of the system whilst also keeping on-going maintenance to a minimum. It is highly recommended that the constructed activities be completed in accordance with *the Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands (Apr 2010)*. This will require a sacrificial turf layer to be installed to protect the filter media from the building phase.

4.2. Operational

It is not proposed for water quality monitoring of the bioretention system to be undertaken during the operational phase of its life. The "*Maintaining Vegetated Asset*" guideline highlights that water quality monitoring is not recommended to determine the performance of every vegetated stormwater asset, as it is a specialized field that is complex and costly. In line with this guideline the on-going monitoring of water quality from this device is not considered necessary considering the small size of the development.

The bioretention system will be maintained by the property owner, who as the asset custodian, will be responsible for the on-going maintenance of the water quality device. Maintenance for the bioretention basin may involve the following:

1. Scheduled inspections;
2. Removal of noxious plants or weeds;
3. Maintaining the desired vegetation;
4. Repairing erosion;
5. Unblocking inlets and outlets;
6. Removing litter and debris;
7. Managing algal or moss growth; and
8. Maintaining the permeability of the filtration.

Operations and maintenance should be conducted in accordance with the *Maintaining Vegetated Stormwater Assets* (Feb 2012) guideline.

5. CONCLUSION

It can be seen from the results, presented in Table 2-5 that the treatment measures proposed for the development site achieve the performance criteria set by the BCC Planning Scheme (2014) and SPP (2017). Annual Load Reductions of Total Suspended Solids (TSS), Total Phosphorus, Total Nitrogen (TN) and Gross Pollutants (GP) between the Mitigated and Unmitigated Scenarios have been achieved.

This plan demonstrates that effective treatment of stormwater at the proposed development can be achieved through the integration of Water Sensitive Urban Design (WSUD) principles. Through the incorporation of bioretention basins and tree pits, the plan successfully demonstrates:

- Compliance with the requirements of the BCC Planning Scheme and SPPs Load Based Objectives;
- The end of line bioretention basins and tree pits are appropriately sized for the proposed development and can be incorporated into the development; and
- Ecological sustainability in terms of the development's impact upon receiving waters and the viability of the proposed site development.

We therefore request Council approval of the engineering components for the proposed development with reasonable and relevant conditions. Detailed design may result in changes to the proposed strategy; however, the design objectives will be maintained.

6. REFERENCES

- Brisbane City Plan: Version 20, (Brisbane City Council 2014).
- http://www.bom.gov.au/water/designRainfalls/revised-ifd (Bureau of Meteorology, Online Rainfall IFD Data System).
- State Planning Policy (Department of Infrastructure, Local Government and Planning, 2017).
- Australian Rainfall and Runoff (Institute of Engineers Australia, 2019).
- Queensland Urban Drainage Manual – 4th Edition (Institute of Public Works Engineering Australasia, Queensland Division, 2017).
- MUSIC Modelling Guidelines, Version 1.0 (Water by Design, 2010).
- MUSIC Modelling Guidelines, *Consultation Draft*, Version 3.0 (Water by Design, 2018).
- Maintaining Vegetated Stormwater Assets (Water by Design, 2012).
- Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands (Water by Design 2012).

APPENDICES

Appendix A Code Response

The Pinnacle – Stages 5-8
9.4.9 Stormwater Code

Performance outcomes	Acceptable outcomes	Response
Section A—If for a material change of use, reconfiguring a lot, operational work or building work Note—Compliance with the performance outcomes and acceptable outcomes in this section should be demonstrated by the submission of a site-based stormwater management plan for high risk development only.		
PO1 Development provides a stormwater management system which achieves the integrated management of stormwater to: (a) minimise flooding; (b) protect environmental values of receiving waters; (c) maximise the use of water sensitive urban design; (d) minimise safety risk to all persons; (e) maximise the use of natural waterway corridors and natural channel design principles. Editor's note—The stormwater management system to be developed to address PO1 is not intended to require management of stormwater quality.	**AO1** Development provides a stormwater management system designed in compliance with the Infrastructure design planning scheme policy.	The stormwater management system for the development will comply with the design planning scheme policy unless otherwise approved by Council. Refer to the Flooding and Stormwater Management Plan prepared by Colliers International Engineering & Design Pty Ltd (Reference FSMP01-V3)
PO2 Development ensures that the stormwater management system and site work does not adversely impact flooding or drainage characteristics of premises which are up slope, down slope or adjacent to the site.	**AO2.1** Development does not result in an increase in flood level or flood hazard on up slope, down slope or adjacent premises.	The proposed development will achieve non-worsening of the upstream and downstream waterways through the implementation of a stormwater management plan. Stormwater discharge consent is currently being obtained for stormwater discharge through Lot 1 on RP216005 and will be provided under separate cover. An interim drain is proposed through 4RP183802 (if required). Refer to drawing 20-0218-P113.
	AO2.2 Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	The stormwater management system for the development will comply with the design planning scheme policy unless otherwise approved by Council. The stormwater management plans will be co-ordinated with the bulk earthworks and stormwater drainage network at the detailed design stage to ensure an optimal design outcome is achieved.

Performance outcomes	Acceptable outcomes	Response
PO3 Development ensures that the stormwater management system does not direct stormwater run-off through existing or proposed lots and property where it is likely to adversely affect the safety of, or cause nuisance to properties.	**AO3.1** Development ensures that the location of the stormwater drainage system is contained within a road reserve, drainage reserve, public pathway, park or waterway corridor.	The proposed stormwater drainage has been shown within a road reserve, drainage reserve, future road or public pathway. Refer to Drawings 20-0218-P108 to P112 & P113.
	AO3.2 Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	The stormwater management system for the development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council.
	AO3.3 Development obtains a lawful point of discharge in compliance with the standards in the Infrastructure design planning scheme policy.	A reticulated stormwater system has been provided throughout Stages 5-8 which ultimately connects into the existing stormwater system on Rochedale Road. Upgrades are proposed to occur to planned downstream trunk infrastructure (ROC-PR-154) along Rochedale Road to a legal point of discharge via an interim drain through 4RP183802 until such time the planned trunk infrastructure (ROC-PR-157) is completed.
	AO3.4 Where on private land, all underground stormwater infrastructure is secured by a drainage easement.	Any underground stormwater within private land will be secured by a drainage easement.
PO4 Development provides a stormwater management system which has sufficient capacity to safely convey run-off taking into account increased run-off from impervious surfaces and flooding in local catchments.	**AO4.1** Development provides a stormwater conveyance system which is designed to safely convey flows in compliance with the standards in the Infrastructure design planning scheme policy.	The stormwater conveyance system will comply with the infrastructure design planning scheme policy unless otherwise approved by Council.
	AO4.2 Development provides sufficient area to convey run-off which will comply with the standards in the Infrastructure design planning scheme policy.	Sufficient area will be provided to convey runoff as required.
PO5	**AO5**	

Performance outcomes	Acceptable outcomes	Response
Development designs stormwater channels, creek modification works, bridges, culverts and major drains to protect and enhance the value of the waterway corridor or drainage path for fauna movement.	Development ensures the design of stormwater channels, creek modifications or other infrastructure, permits terrestrial and aquatic fauna movement.	No works are proposed that would require stormwater design permits or terrestrial and aquatic fauna movement provisions. The discharge points of the development will be constructed to ensure minimal disturbance within the waterway corridor.
PO6 Development ensures that location and design of stormwater detention and water quality treatment: (a) minimises risk to people and property; (b) provides for safe access and maintenance; (c) minimises ecological impacts to creeks and waterways.	**AO6.1** Development locates stormwater detention and water quality treatment: (a) outside of a waterway corridor; (b) offline to any catchment not contained within the development.	Stormwater Quality objectives are met as required by the Brisbane City Council Planning Scheme Policy and State Planning Policy (SPP). Specifically, the water quality objectives for post development will be satisfied through the implementation of best practice end of line stormwater quality bio-filtration basins and inclusion of WSUD tree pits throughout the development. These have been adequately sized to effectively mitigate the pollutant loads generated from the site to the SPP pollutant load reduction targets.
	AO6.2 Development providing for stormwater detention and water quality treatment devices are designed in compliance with the standards in the Infrastructure design planning scheme policy.	Stormwater Quality objectives are met as required by the Brisbane City Council Planning Scheme Policy and State Planning Policy (SPP). Specifically, the water quality objectives for post development will be satisfied through the implementation of best practice end of line stormwater quality bio-filtration basins and inclusion of WSUD tree pits throughout the development. These have been adequately sized to effectively mitigate the pollutant loads generated from the site to the SPP pollutant load reduction targets.
PO7 Development is designed, including any car parking areas and channel works to: (a) reduce property damage; (b) provide safe access to the site during the defined flood event.	**AO7.1** Development (including any ancillary structures and car parking areas) is located above minimum flood immunity levels in Table 9.4.9.3.B, Table 9.4.9.3.C, Table 9.4.9.3.D, Table 9.4.9.3.E and Table 9.4.9.3.F. Note—Compliance with this acceptable outcome can be demonstrated by the submission of a hydraulic and hydrology report	The development will be designed in accordance with the infrastructure design planning scheme policy and will be located above minimum levels in the outlined tables.

Performance outcomes	Acceptable outcomes	Response
	identifying flood levels and development design levels (as part of a site-based stormwater management plan).	
	AO7.2 Development including the road network provides a stormwater management system that provides safe pedestrian and vehicle access in accordance with the standards in the Infrastructure design planning scheme policy.	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council. The stormwater management plans will be co-ordinated with the bulk earthworks and stormwater drainage network at the detailed design stage to ensure an optimal design outcome is achieved.
PO8 Development designs stormwater channels, creek modification works and the drainage network to protect and enhance the environmental values of the waterway corridor or drainage path.	**AO8.1** Development ensures natural waterway corridors and drainage paths are retained.	The proposed storm water strategy will achieve non-worsening of the upstream and downstream waterway through the implementation of the Flooding and Stormwater Management Plan prepared by Colliers International Engineering & Design Pty Ltd (Reference FSMP01-V3).
	AO8.2 Development provides the required hydraulic conveyance of the drainage channel and floodway, while maximising its potential to maximise environmental benefits and minimise scour. Editor's note—Guidance on natural channel design principles can be found in the Council's publication Natural channel design guidelines.	The proposed Flooding and Stormwater Management Plan prepared by Colliers International Engineering & Design Pty Ltd (Reference FSMP01-V3) demonstrates how hydraulic conveyance of existing overland flow paths have been considered.
	AO8.3 Development provides stormwater outlets into waterways, creeks, wetlands and overland flow paths with energy dissipation to minimise scour in compliance with the	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council.

Performance outcomes	Acceptable outcomes	Response
	standards in the Infrastructure design planning scheme policy.	Operational works applications will be submitted for approval by Council.
	AO8.4 Development ensures that the design of modifications to the existing design of new stormwater channels, creeks and major drains is in compliance with the standards in the Infrastructure design planning scheme policy.	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council. The proposed Flooding and Stormwater Management Plan prepared by Colliers International Engineering & Design Pty Ltd (Reference FSMP01-V3) demonstrates how hydraulic conveyance of existing overland flow paths have been considered.
PO9 Development is designed to manage run-off and peak flows by minimising large areas of impervious material and maximising opportunities for capture and re-use.	**AO9** No acceptable outcome is prescribed.	Flows generated by the development will be managed in accordance with Council requirements and through the implementation of the Flooding and Stormwater Management Plan prepared by Colliers International Engineering & Design Pty Ltd (Reference FSMP01-V3).
PO10 Development ensures that there is sufficient site area to accommodate an effective stormwater management system. Note—Compliance with the performance outcome should be demonstrated by the submission of a site-based stormwater management plan for high-risk development only.	**AO10** No acceptable outcome is prescribed.	Sufficient site area will be provided for stormwater management as approved by Council.
PO11 Development provides for the orderly development of stormwater infrastructure within a catchment, having regard to the: (a) existing capacity of stormwater infrastructure within and external to the site, and any planned stormwater infrastructure upgrades; (b) safe management of stormwater discharge from existing and future up-slope development;	**AO11.1** Development with up-slope external catchment areas provides a drainage connection sized for ultimate catchment conditions that is directed to a lawful point of discharge.	A drainage connection will be provided for up-slope external catchments if required.
	AO11.2 Development ensures that existing stormwater infrastructure that is undersized is upgraded in compliance with the Infrastructure design planning scheme policy.	Upgrades to occur to planned downstream trunk infrastructure (ROC-PR-154) along Rochedale Road to a legal point of discharge via an interim drain through 4RP183802 until such

Performance outcomes	Acceptable outcomes	Response
(c) implication for adjacent and down-slope development.	Development ensures that existing stormwater infrastructure that is undersized is upgraded in compliance with the Priority infrastructure plan and the standards in the Infrastructure design planning scheme policy.	time the planned trunk infrastructure (ROC-PR-157) is completed.
PO12 Development provides stormwater infrastructure which: (a) remains fit for purpose for the life of the development and maintains full functionality in the design flood event; (b) can be safely accessed and maintained cost effectively; (c) ensures no structural damage to existing stormwater infrastructure.	**AO12.1** The stormwater management system is designed in compliance with the Infrastructure design planning scheme policy.	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council. The stormwater management plans will be co-ordinated with the bulk earthworks and stormwater drainage network at the detailed design stage to ensure an optimal design outcome is achieved.
	AO12.2 Development provides a clear area with a minimum of 2m radius from the centre of an existing manhole cover and with a minimum height clearance of 2.5m.	Development will comply with the infrastructure design planning scheme policy unless otherwise approved by Council.
PO13 Development ensures that all reasonable and practicable measures are taken to manage the impacts of erosion, turbidity and sedimentation, both within and external to the development site from construction activities, including vegetation clearing, earthworks, civil construction, installation of services, rehabilitation, revegetation and landscaping to protect: (a) the environmental values and water quality objectives of waters; (b) waterway hydrology; (c) the maintenance and serviceability of stormwater infrastructure. Note—The Infrastructure design planning scheme policy outlines the appropriate measures to be taken into account to achieve the performance outcome.	**AO13** No acceptable outcome is prescribed.	Development will adopt best practices to reasonably minimize impacts from erosion, turbidity and sedimentation.
PO14 Development ensures that:	**AO14** No acceptable outcome is prescribed.	Development will adopt best practices to reasonably minimize disturbance and erosion.

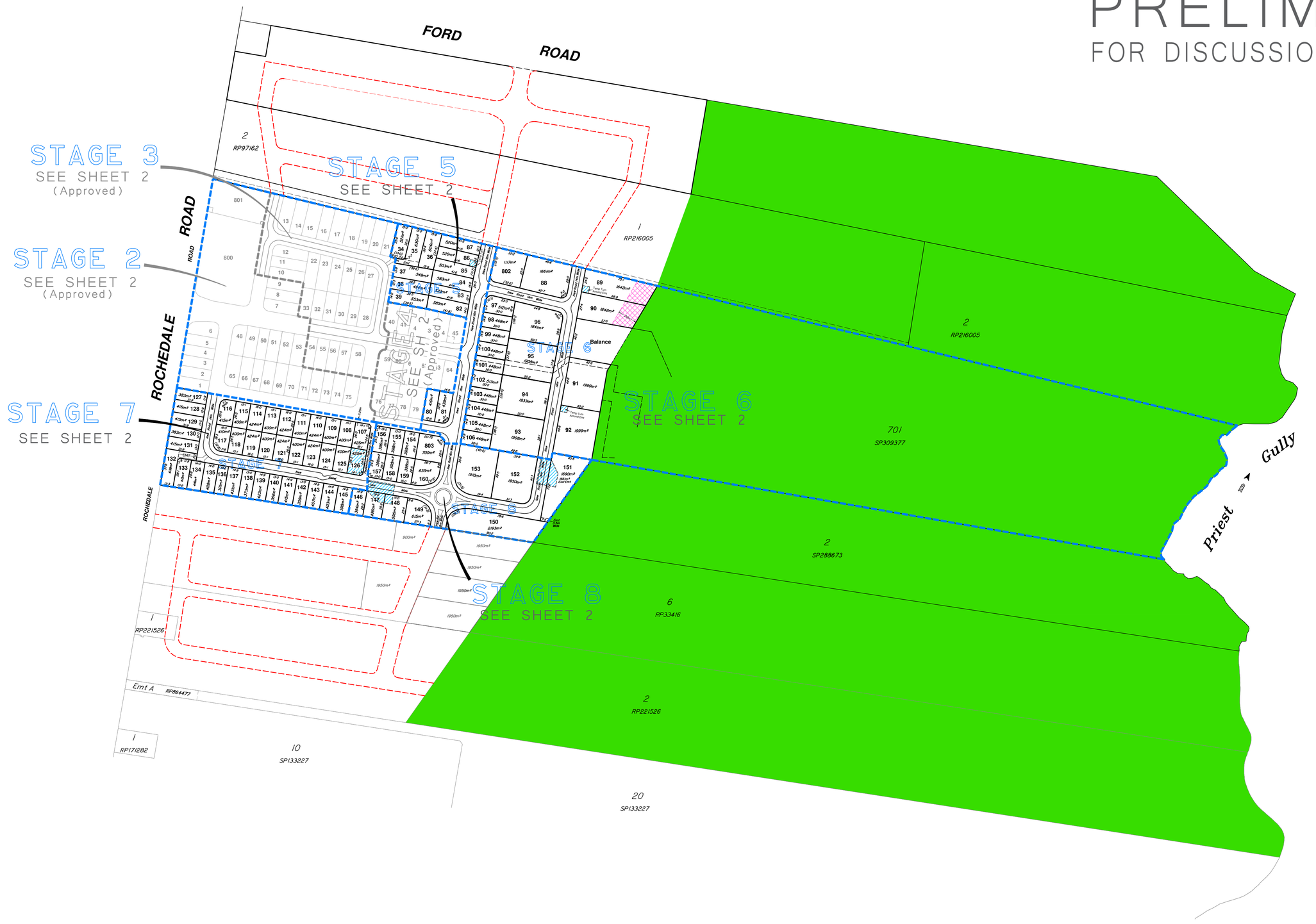
Performance outcomes	Acceptable outcomes	Response
(a) unnecessary disturbance to soil, waterways or drainage channels is avoided; (b) all soil surfaces remain effectively stabilised against erosion in the short and long term.		
PO15 Development does not increase: (a) the concentration of total suspended solids or other contaminants in stormwater flows during site construction; (b) run-off which causes erosion either on site or off site.	**AO15** No acceptable outcome is prescribed.	Erosion and sediment control will be implemented as a part of development. A certified ESC plan will be obtained, and necessary prestart meetings will be undertaken. Audits will be conducted by the Superintendent throughout construction to confirm controls are satisfactory.
Section B—Additional criteria which apply to high-risk development, being one or more of the following: (a) a material change of use for an urban purpose which involves greater than 2,500m^2 of land that: (i) will result in an impervious area greater than 25% of the net developable area; or (ii) will result in 6 or more dwellings. (b) reconfiguring a lot for an urban purpose that involves greater than 2,500m^2 of land and will result in 6 or more lots; (c) operational work for an urban purpose which involves disturbing greater than 2,500m^2 of land.		
PO16 Development ensures that the entry and transport of contaminants into stormwater is avoided or minimised to protect receiving water environmental values. Note—Prescribed water contaminants are defined in the *Environmental Protection Act 1994*. Note—Compliance with the performance outcome should be demonstrated by the submission of a site-based stormwater management plan for high-risk development only.	**AO16** Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	Erosion and sediment control will be implemented as a part of development. A certified ESC plan will be obtained, and necessary prestart meetings will be undertaken. Audits will be conducted by the Superintendent throughout construction to confirm controls are satisfactory. Water quality objectives for post development will be satisfied through the implementation of best practice end of line stormwater quality bio-filtration basins and inclusion of WSUD tree pits throughout the development.
PO17 Development ensures that: (a) the discharge of wastewater to a waterway or external to the site is avoided; or (b) if the discharge cannot practicably be avoided, the development minimises	**AO17** No acceptable outcome is prescribed.	N/A - wastewater will discharge to a sewer reticulation network in accordance with QUU requirements.

Performance outcomes	Acceptable outcomes	Response
wastewater discharge through re-use, recycling, recovery and treatment. Note—The preparation of a wastewater management plan can assist in demonstrating achievement of this performance outcome. Editor's note—This code does not deal with sewerage which is the subject of the Wastewater code.		
Section C—Additional performance outcomes and acceptable outcomes for assessable development for a material change of use or reconfiguring a lot.		
PO18 Development protects stormwater infrastructure to ensure the following are not compromised: a. the long term infrastructure for the stormwater network in the Long term infrastructure plans; b. the existing and planned infrastructure for the stormwater network in the Local government infrastructure plan; c. the provision of long term, existing and planned infrastructure for the stormwater network which: i. is required to service the development or an existing and future urban development in the planning scheme area; or ii. is in the interests of rational development or the efficient and orderly planning of the general area in which the site is situated. Editor's note—A condition which requires a proposed development to keep permanent improvements and structures associated with the approved development clear of the area of long term infrastructure, may be imposed.	**AO18** Development protects stormwater infrastructure in compliance with the following: a. for long term infrastructure for the stormwater network, the Long term infrastructure plans; b. for existing and planned infrastructure for the stormwater network, the Local government infrastructure plan; c. the standards for stormwater drainage in the Infrastructure design planning scheme policy.	Works will comply with the infrastructure design planning scheme policy and development guidelines unless otherwise approved by Council.
PO19 Development provides for the payment of extra trunk infrastructure costs for the following: a. for development completely or partly outside the priority infrastructure area in the Local government infrastructure plan; b. for development completely inside the priority infrastructure area in the Local government infrastructure plan involving: i. trunk infrastructure that is to be provided earlier than planned in the Local government infrastructure plan;	**AO19** No acceptable outcome is prescribed.	The development is located within the Local Government Infrastructure Plan and will be delivered in accordance with the accepted conditions of approval.

Performance outcomes	Acceptable outcomes	Response
ii. long term infrastructure for the stormwater network which is made necessary by development that is not assumed future urban development; iii. other infrastructure for the stormwater network associated with development that is not assumed future urban development which is made necessary by the development. Editor's note—The payment of extra trunk infrastructure costs for development completely inside the priority infrastructure area in the Local government infrastructure plan is to be worked out in accordance with the Charges Resolution. Editor's note—See section 130 Imposing Development conditions (Conditions for extra trunk infrastructure costs) of the Planning Act		

Appendix B Reconfiguration of Lot Plan

PRELIMINARY
FOR DISCUSSION PURPOSES



Legend

- Regional Landscape and Rural Production Area/Environmental Management Zone
- Dwelling Exclusion Zone - 20m wide
- Temporary Turnaround Easement
- Proposed Stage Boundary
- Proposed Road

Notes

1. Any licence, express or implied, to use this document for any purpose whatsoever is restricted to the terms of the agreement or implied agreement between Wolter Consulting Group and the instructing party.

2. Design subject to local authority approval & detailed engineering requirements , areas and dimensions are approximate only and are subject to survey. Therefore this drawing is not to be used for engineering design.

3. This note is an integral part of this plan. This plan may not be reproduced without this notation being included.

Table of Development

Gross area of subject land	27.19 ha
Area of proposed park and open space (Including drainage reserve)	1.093ha
Area of new road	3.716 ha
Length of new road	2815m
Net area of subject land (Excluding new road, park & open space)	22.38ha
Number of proposed residential lots	102
Number of existing lots	6

Final intended use of new lots:

Proposed Lots 1-45,48-255 are for residential use.
Proposed Lot 800 is for park and open space.
Proposed Lots 801-806 is for Drainage.

WOLTER consulting group
Planning Urban Design Landscape Environment Surveying
Brisbane: Level 2, 1 Breakfast Ck Road, Newstead, QLD 4006 Phone: (07) 3666 5200

Scale 1:2000 @ A1 - Lengths are in Metres.
20 0 20 40 60 80 100 120 140 160 180 200

Plan of Reconfiguration

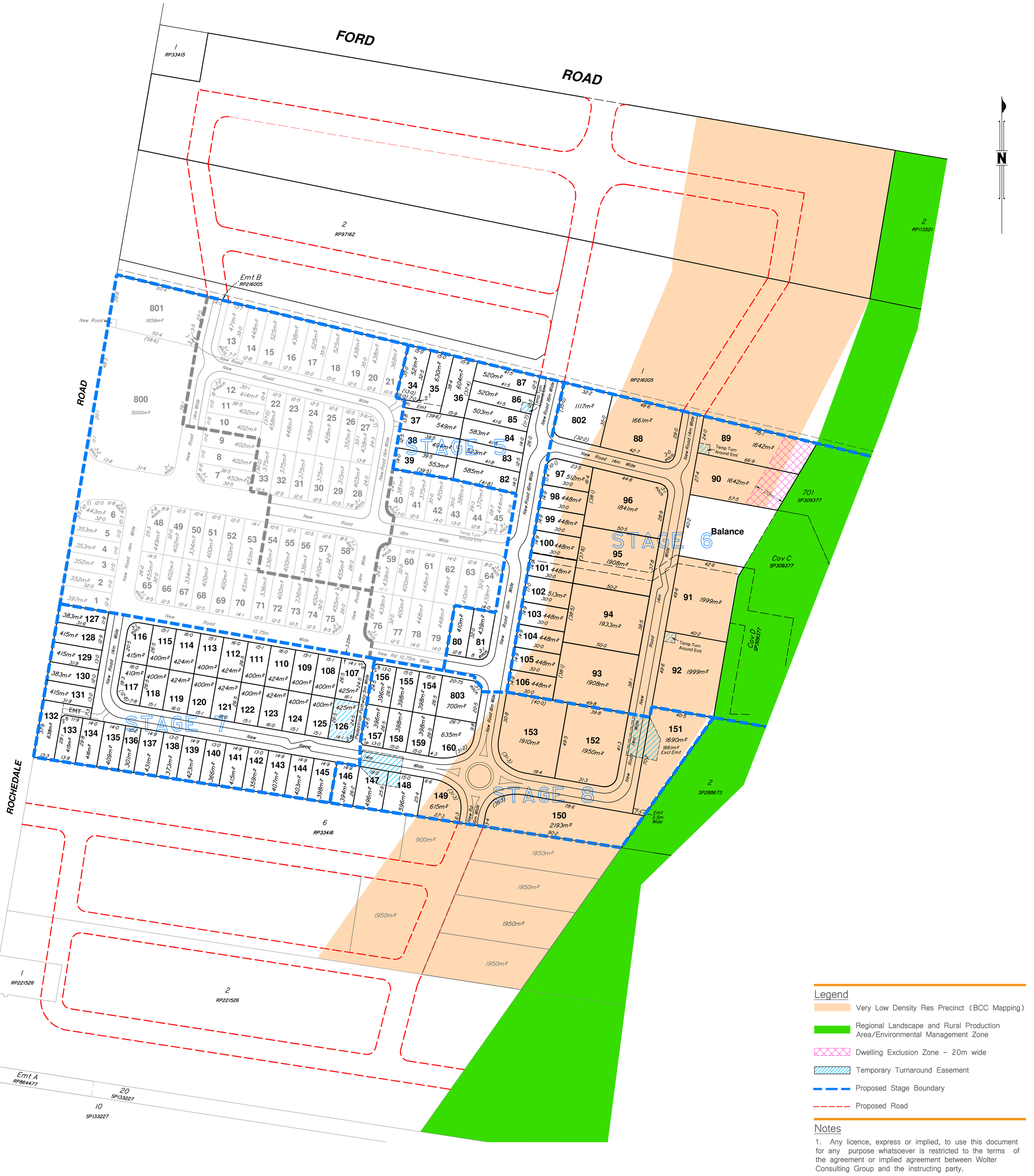
Rochedale Road, Rochedale

Local Authority — Brisbane City

Description
Lot 1 on SP288673, Lot 3 on RP181371 & Lots 700 & 701 on SP309377

DRAWING NO.	VERSION
SB1039-14-01	AE
DATE DRAWN	SHEET NO.
16-09-2022	1 of 2

PRELIMINARY
FOR DISCUSSION PURPOSES



Legend

- Very Low Density Res Precinct (BCC Mapping)
- Regional Landscape and Rural Production Area/Environmental Management Zone
- Dwelling Exclusion Zone – 20m wide
- Temporary Turnaround Easement
- Proposed Stage Boundary
- Proposed Road

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Table of Development

Gross area of subject land	22.97 ha
Area of proposed park and open space (Including drainage reserve)	8393m²
Area of new road	1.668 ha
Length of new road	1450m
Net area of subject land (Excluding new road, park & open space)	20.46ha
Number of proposed residential lots	188
Number of existing lots	6

Final intended use of new lots:

Proposed Lots 1-45,48-190 are for residential use.
Proposed Lot 800 is for park and open space.
Proposed Lots 802 & 804 is for Drainage.

WOLTER consulting group
Planning Urban Design Landscape Environment Surveying
Brisbane: Level 2, 1 Breakfast Ck Road, Newstead, QLD 4006 Phone: (07) 3666 5200

Scale 1:1000 @ A1 – Lengths are in Metres.

10 0 10 20 30 40 50 60 70 80 90 100

Plan of Reconfiguration

Rochedale Road, Rochedale

Local Authority: Brisbane City

Description: Lot 1 on SP288673, Lot 3 on RP181371 & Lots 700 & 701 on SP309377

DRAWING NO. SB1039-14-01

VERSION AE

DATE DRAWN 16-09-2022

SHEET NO. 2 of 2